

## **Report on Short-Term Course on “Artificial Intelligence for Civil Engineers - Concepts and Practices for Civil Engineers” from 16<sup>th</sup> September to 20<sup>th</sup> September 2024**

The Short-Term Course (STC) on "Artificial Intelligence - Concepts and Practices for Civil Engineers" was organized by the National Institute of Technical Teachers Training and Research (NITTTR) Chandigarh in association with Department of Civil Engineering, Integral University, as a remote centre from 16<sup>th</sup> September to 20<sup>th</sup> September 2024. The programme aimed to enhance the understanding and application of Artificial Intelligence (AI) among faculty members and students in the fields of civil engineering and related disciplines. A total of 16 Academic Staff members and 16 PG students have attended the programme from Integral University, Remote centre for NITTTR. The Day wise report of the STC is as follows:

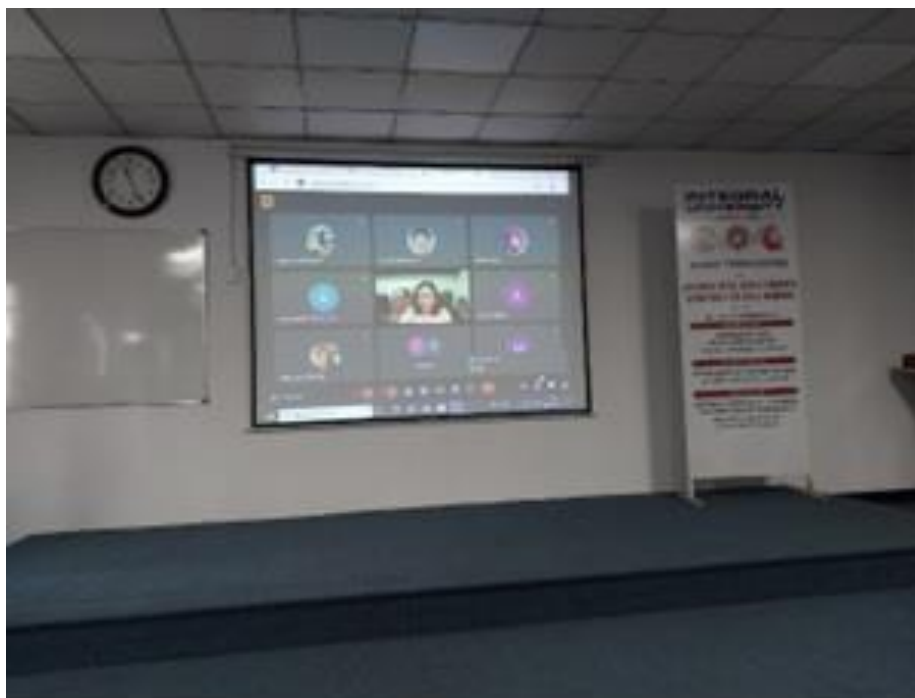
### **Day 1: Inauguration and Introduction to AI**

**Inauguration:** The programme commenced with an inaugural session where the significance of AI in modern engineering was highlighted.

The first session of the day was a foundational session titled "Artificial Intelligence – An Introduction," presented by Dr. Himmi Gupta, Assistant Professor, NITTTR Chandigarh. Ms. Gupta provided a comprehensive overview of AI, covering its core concepts, historical evolution, and transformative impact on engineering disciplines. He emphasized AI's role in improving efficiency and decision-making, laying a solid groundwork for participants.

Ms. Gupta then delved into "AI Applications in Architecture, Engineering, and Construction," where he highlighted practical use cases of AI technologies in these fields. Participants learned how AI optimizes design processes, enhances project management, and streamlines construction operations, showcasing its potential to reshape the industry through data-driven decision-making.

The third session featured Mr. Manash Chatterjee, Managing Director of the Tickoo Institute of Emerging Technologies (TIET), who discussed "BIM and Digital Twins and their Application for Design, Construction, and Maintenance of Infrastructure." Chatterjee explored how Building Information Modelling (BIM) facilitates collaboration and improves project visualization, while Digital Twins create virtual replicas of physical assets for real-time monitoring and predictive maintenance. Together, these sessions equipped participants with essential knowledge on integrating AI into civil engineering practices, setting the stage for further exploration in the programme.



*Inaugural Session of STC going on at Department of Civil Engineering, Integral University*

## **Day 2: Machine Learning and Programming**

The second day of the Short Term Course focused on machine learning and programming, beginning with "Essentials of Machine Learning," delivered by Dr. Mala Kalra Assistant Professor, NITTTR Chandigarh. In this session, Dr. Kalra introduced fundamental concepts, highlighting the significance of machine learning in data analysis and prediction. She explained key algorithms and the different types of machine learning—supervised, unsupervised, and reinforcement—using real-world examples to illustrate their applications in solving engineering problems.

Following this theoretical foundation, Dr. Kalra conducted a hands-on workshop on Python programming, crucial for implementing machine learning algorithms. Participants engaged in practical exercises, allowing them to write and execute code and reinforcing their technical skills in data analysis.

The day concluded with a session on "Artificial Neural Networks" by Er. Shano Solanki, NITTTR Chandigarh. Ms. Solanki discussed the structure and functioning of neural networks, explaining how they mimic human brain processes. She covered various network architectures and their applications in tasks such as image recognition and natural language processing, showcasing practical implementations. Together, these sessions equipped participants with essential knowledge and skills in machine learning and programming, preparing them to apply AI technologies in their engineering practices.

## **Day 3: Advanced AI Concepts**

The third day of the Short Term Course featured important sessions on fuzzy logic and its applications in hydrology. Er. Shano Solanki from NITTTR Chandigarh opened the day with "Basics of Fuzzy Logic and its Implementation." He introduced participants to the core principles

of fuzzy logic, explaining how it allows for degrees of truth rather than a strict true/false approach. Solanki highlighted the mathematical foundations of fuzzy sets and the role of linguistic variables in modelling uncertainty, using practical examples to demonstrate its effectiveness in engineering decision-making.

Following this, Dr. N.V. Umamahesh, Professor, NIT Warangal, presented on "Applications of Artificial Neural Networks (ANN) and Fuzzy Logic in Hydrology." He explored how these advanced computational techniques can be applied to complex hydrological challenges, such as rainfall prediction, flood forecasting, and water quality assessment. Dr. Umamahesh emphasized the synergy between ANN and fuzzy logic, illustrating how their combined use improves modelling accuracy and decision-making in water resource management. Through case studies and real-world examples, he provided participants with valuable insights into the practical implications of these technologies. Together, these sessions enhanced participants' understanding of fuzzy logic and its applications in hydrology, equipping them with the tools to implement these techniques in their engineering practices.

#### **Day 4: Data Analysis and Specialized Applications**

The fourth day of the Short Term Course focused on practical applications of AI and data analysis in engineering. Dr. Mala Kalra led a session on "Data Analysis using Python," which included hands-on practice. She introduced essential techniques for data manipulation and visualization using Python, guiding participants through exercises that reinforced theoretical concepts while equipping them with practical skills for data analysis in their own projects.

Next, Dr. Subhamoy Sen, Associate Professor, IIT Mandi, presented on "Physics-Informed Neural Networks for Monitoring Renewable Energy Structures." He discussed how integrating physics-based models with machine learning enhances predictive accuracy for monitoring systems like wind turbines and solar panels. This approach improves performance prediction and fault detection, leading to more effective maintenance strategies in renewable energy infrastructure.

The day concluded with a presentation by Ar. Jit Kumar Gupta, former Advisor, Town Planning at Punjab Urban Planning and Development Authority (PUDA), on "Intelligent Buildings." He explored how AI and advanced technologies are transforming architectural practices, focusing on smart systems that enhance energy efficiency, security, and occupant comfort. Gupta showcased case studies of intelligent building systems, illustrating their potential for creating sustainable living environments. Together, these sessions provided participants with valuable insights and tools to apply AI and data analysis in innovative ways within their engineering practices.

#### **Day 5: Practical Applications and Valediction**

The final day of the Short-Term Course highlighted practical applications of AI in road maintenance and creative content generation. Dr. Rahul Kalra from Road Athena in Mohali began with a presentation on the "Use of AI Technology in Road Maintenance and Digitization of Roads." He discussed how AI enhances road infrastructure management through predictive analytics, showcasing tools that monitor road conditions, automate data collection, and optimize

maintenance schedules. His insights underscored AI's potential to reduce costs and improve safety in road networks.

Following this, Dr. Gaurav Kumar, Director of Magma Research and Consultancy Services, presented on "Multimedia Content Creation using Generative AI." He explored how generative AI technologies are transforming content creation across various fields, enabling high-quality multimedia outputs with minimal human input. Dr. Kumar illustrated applications in marketing, entertainment, and education, emphasizing the importance of harnessing these technologies to enhance creativity and efficiency.

The programme concluded with a feedback session led by Er. Himmi Gupta, Dr. Mala Kalra, and Er. Shano Solanki, who facilitated valediction ceremony. They encouraged participants to reflect on their learning and consider how to apply their newfound knowledge in their professional fields. This closing discussion fostered community among attendees and highlighted the importance of ongoing collaboration in the evolving landscape of artificial intelligence in engineering. Together, these sessions provided valuable insights into AI's transformative potential across various sectors, inspiring participants to embrace innovative technologies in their future endeavours.

The Detailed STC schedule is as follows:

	<b>10:00 AM -11:30 AM</b>		<b>11.45 – 1:15 PM</b>	<b>2:30-4:00PM</b>
16.09.2024 Monday	Inauguration	Artificial Intelligence – An Introduction <b>(Himmi Gupta, NITTTR, Chandigarh )</b>	AI Applications in Architecture, Engineering and Construction <b>(Himmi Gupta, NITTTR, Chandigarh )</b>	BIM and Digital Twins and their application for Design, construction and Maintenance of Infrastructure <b>(Manash Chatterjee, Managing Director, Tickoo Institute of Emerging Technologies (TIET))</b>
17.09.2024 Tuesday	Essentials of Machine Learning <b>(Dr. Mala Kalra, NITTTR, Chandigarh)</b>		Python Programming including Hands-on-practice <b>(Dr. Mala Kalra, NITTTR, Chandigarh)</b>	Artificial Neural Network <b>(Er. Shano Solanki, NITTTR Chandigarh)</b>
18.09.2024 Wednesday	Basics of Fuzzy Logic and its Implementation <b>(Er. Shano Solanki, NITTTR Chandigarh)</b>			Applications of ANN and Fuzzy Logic in Hydrology <b>(Dr. N.V. Umamahesh, Prof (HAG), Department of Civil Engineering, NIT Warangal)</b>
19.09.2024 Thursday	Data Analysis using Python including Hands-on- practice <b>(Dr. Mala Kalra, NITTTR, Chandigarh)</b>	Physics-Informed Neural Network for monitoring of Renewable Energy Structures <b>(Dr. Subhamoy Sen, Associate Professor, IIT Mandi)</b>		Intelligent Buildings <b>(Ar. Jit Kumar Gupta, Former Advisor-Town Planning PUDA)</b>

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20.09.2024 Friday	Use of AI technology in road maintenance and digitization of roads <b>(Dr. Rahul Kalra, Road Athena, Mohali)</b>	Multimedia Content Creation using Generative AI <b>(Dr. Gaurav Kumar, Director, Magma Research and Consultancy Services, Ambala)</b>	Discussion with Participants Feedback & Valediction <b>(Er. Himmi Gupta/Dr. Mala Kalra/Er. Shano Solanki )</b>



*A glimpse of STC going on and Valedictory Session*